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Hiraoka

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(54) **SPINNING REEL**

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A01K 89/01 (2006.01)

(52) **U.S. Cl.**
CPC ***A01K 89/0114*** (2013.01)

(58) **Field of Classification Search**
CPC A01K 899/0114
USPC 242/278, 279
See application file for complete search history.

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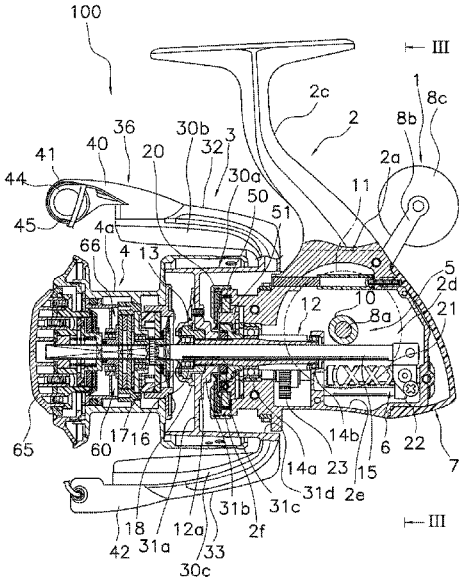
(57) **ABSTRACT**

A spinning reel includes a handle, a reel unit, a rotor, a spool, a spool shaft, and an oscillating mechanism. The oscillating mechanism includes a traverse cam and a slider including a slider body, a through hole, an engaging member, a first bearing, and a retainer member. The slider body is coupled to the spool shaft. The engaging member has a shaft part and an engaging part. The engaging part is mounted to a tip end of the shaft part to be engaged with helical grooves. The first bearing has a fitted part, a protruding part, and a support hole. The fitted part is fitted into the through hole. The protruding part has a diameter smaller than a diameter of the fitted part. The fitted part includes a stepped surface on an end thereof abutting the protruding part. The retainer member retains the first bearing at the stepped surface.

11 Claims, 9 Drawing Sheets



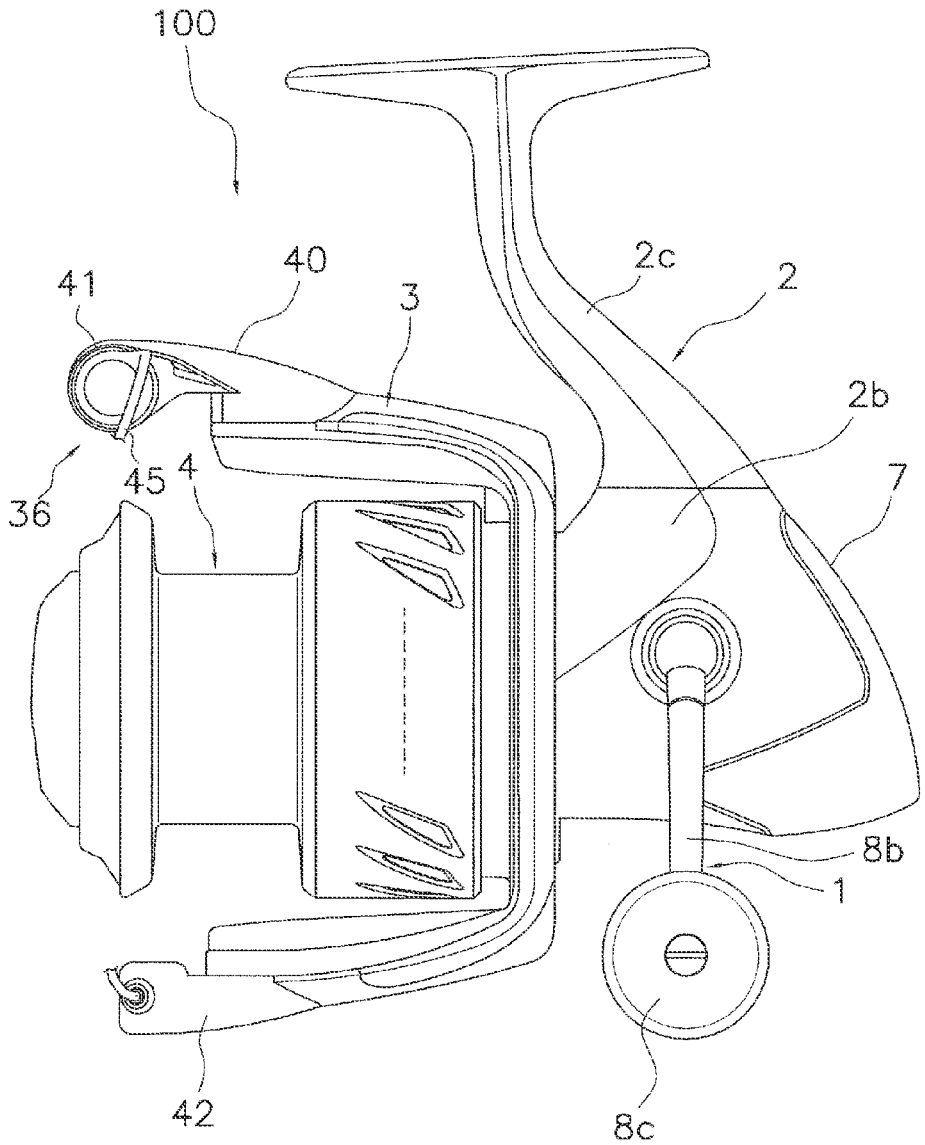


FIG. 1

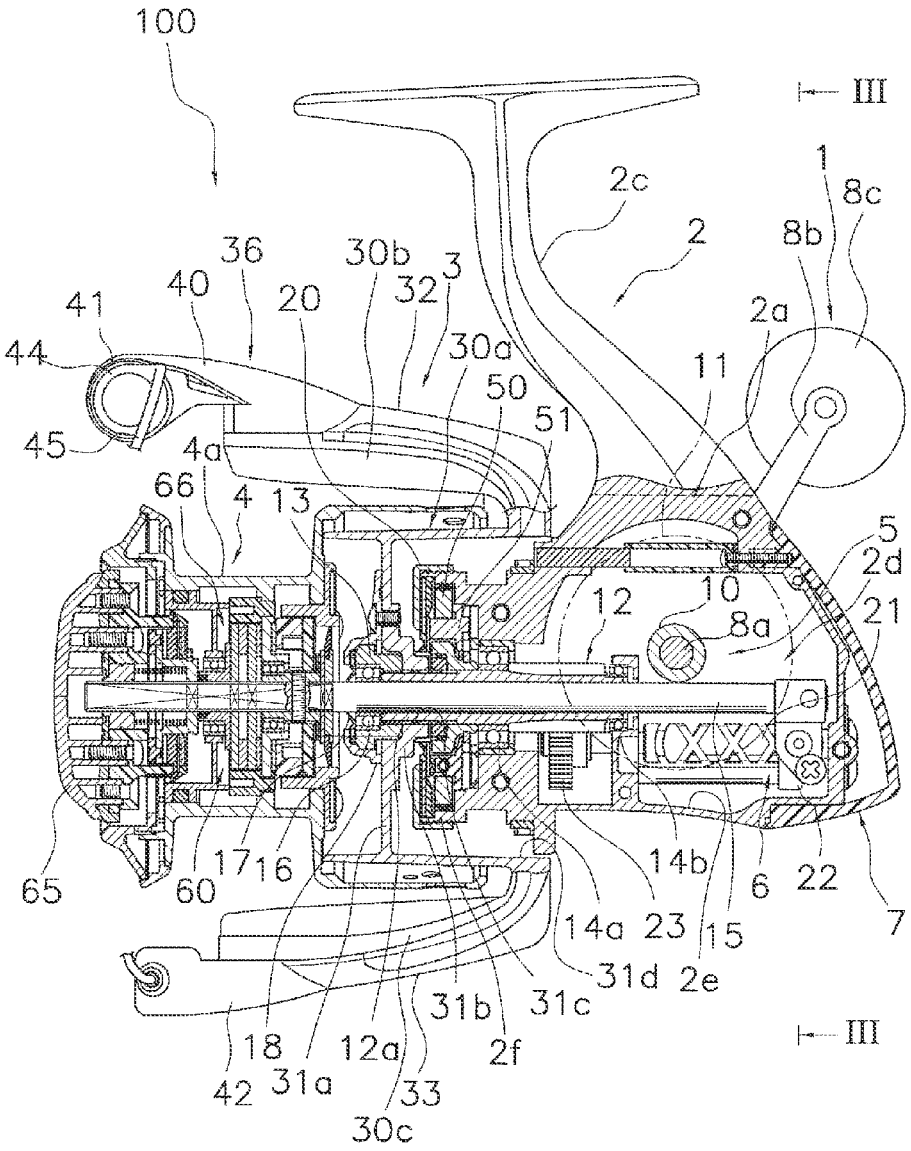

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FIG. 2

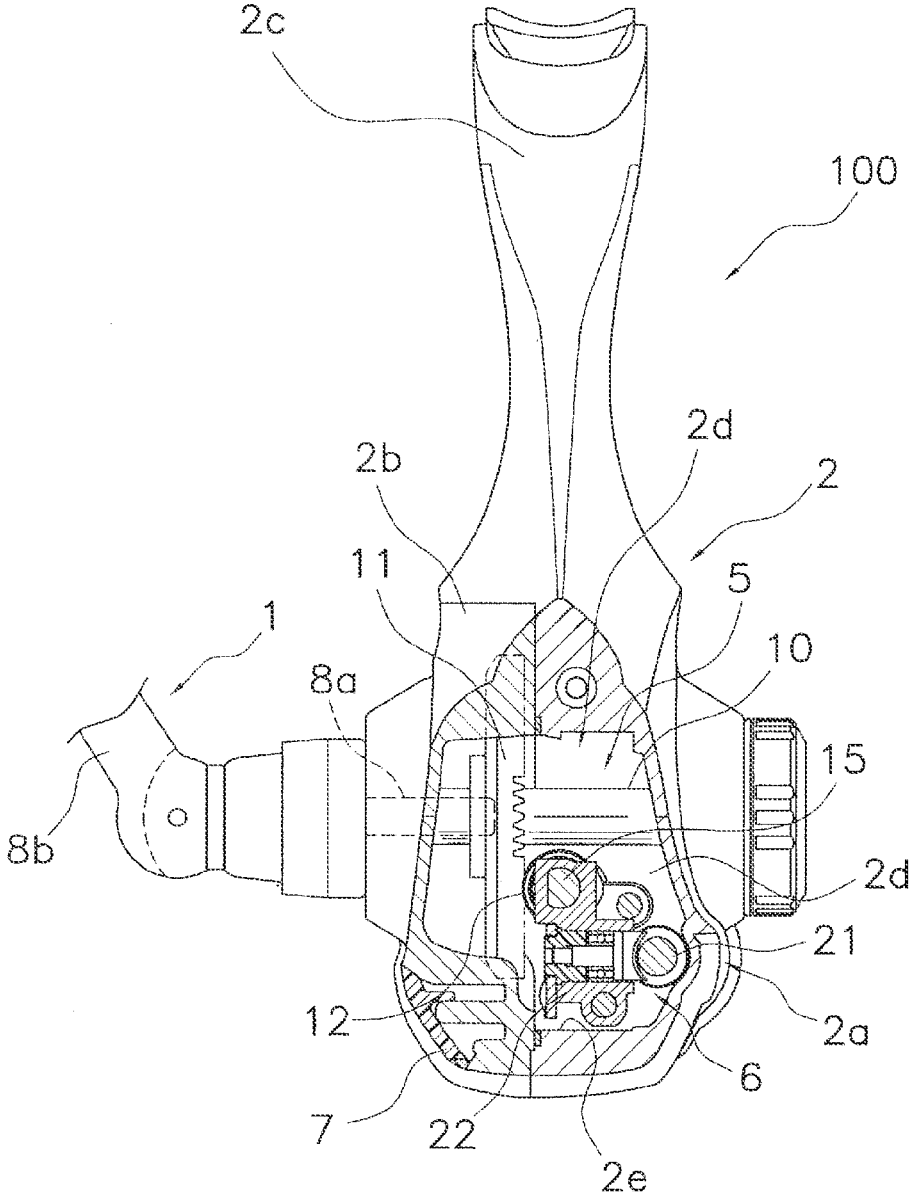

FIG. 3

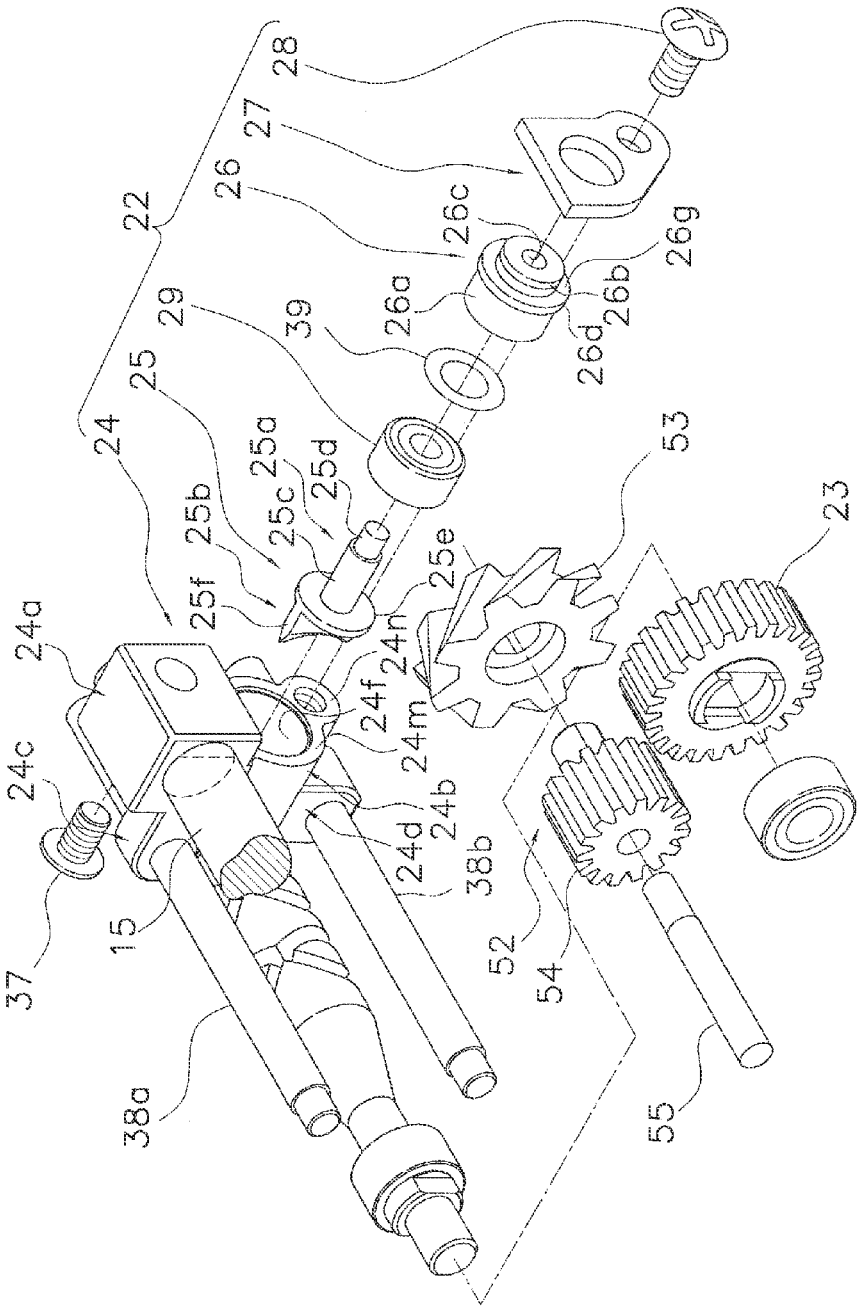
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FIG. 4

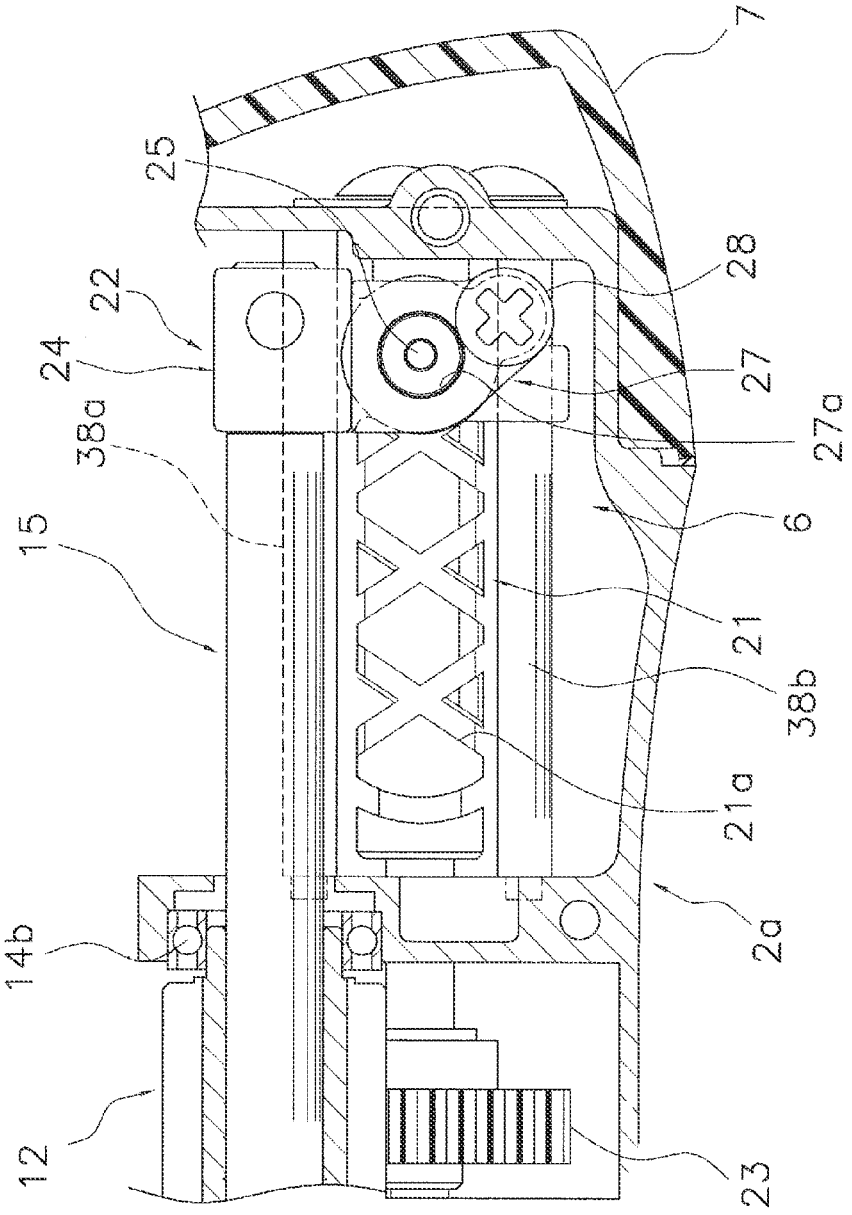

FIG. 5

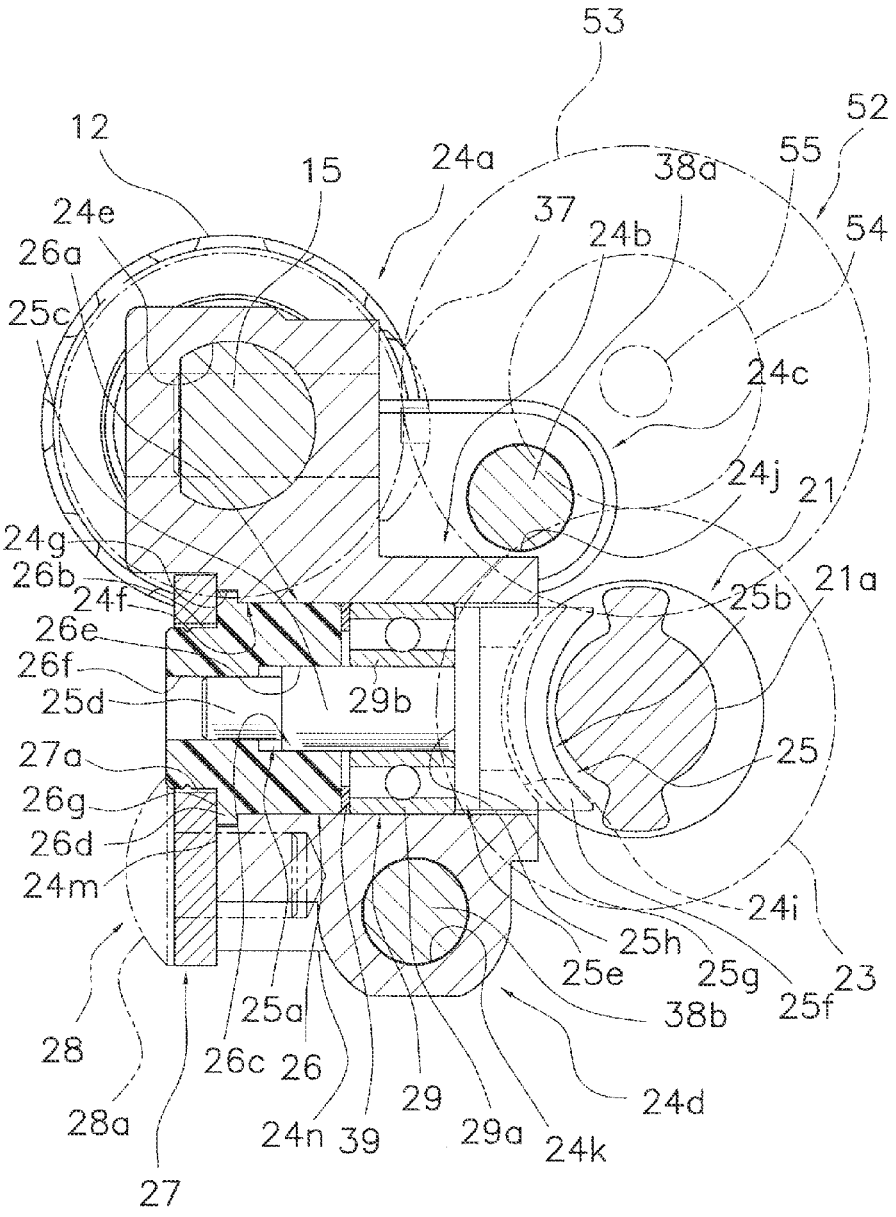
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FIG. 6

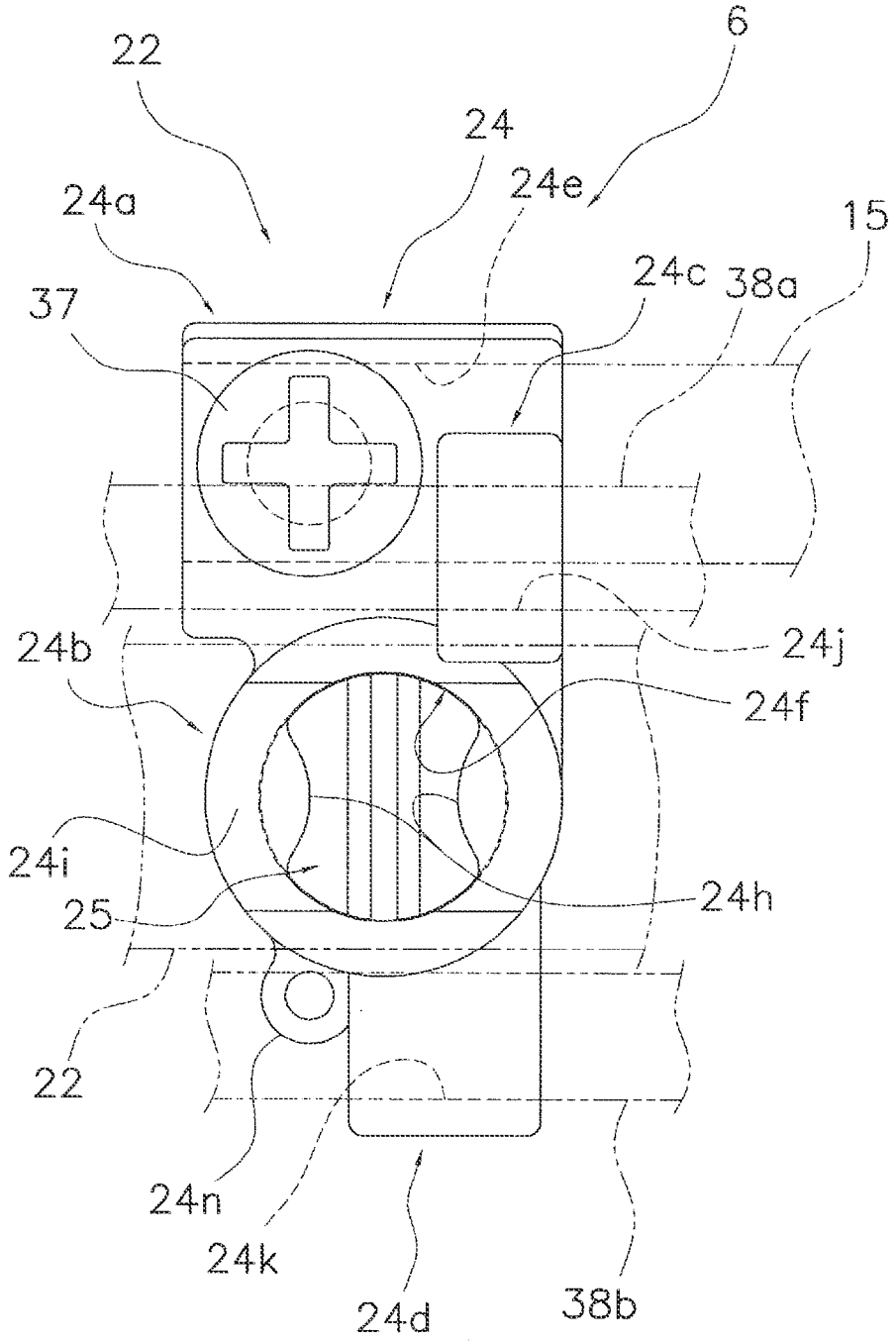
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FIG. 7

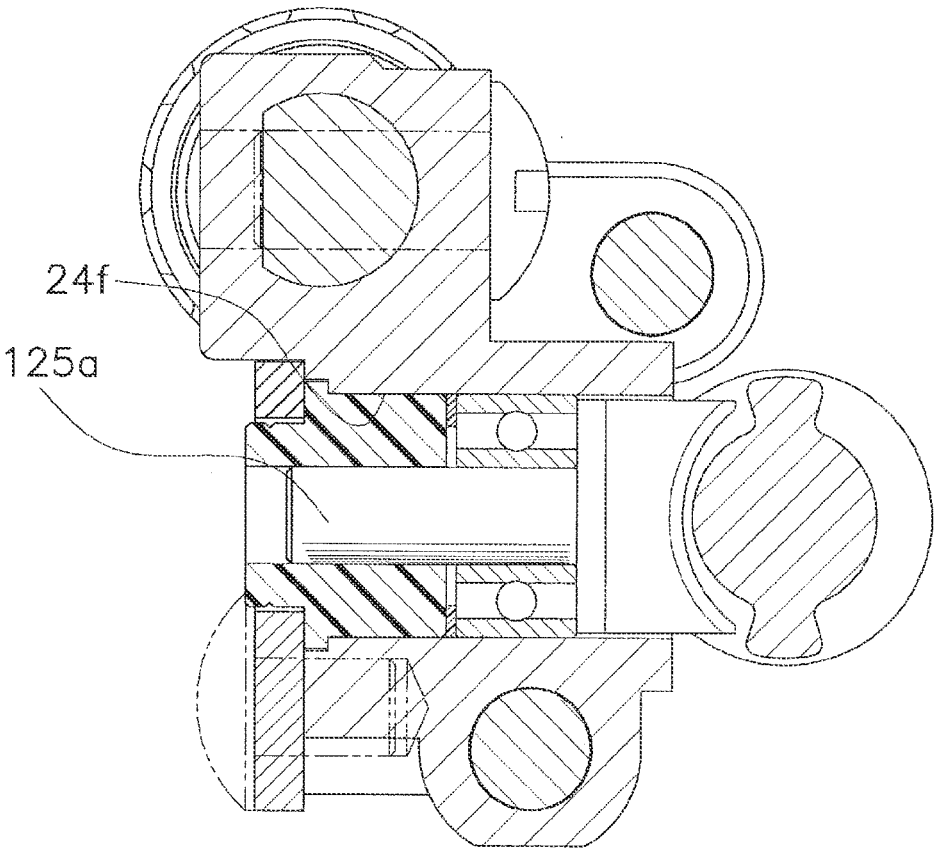

FIG. 8

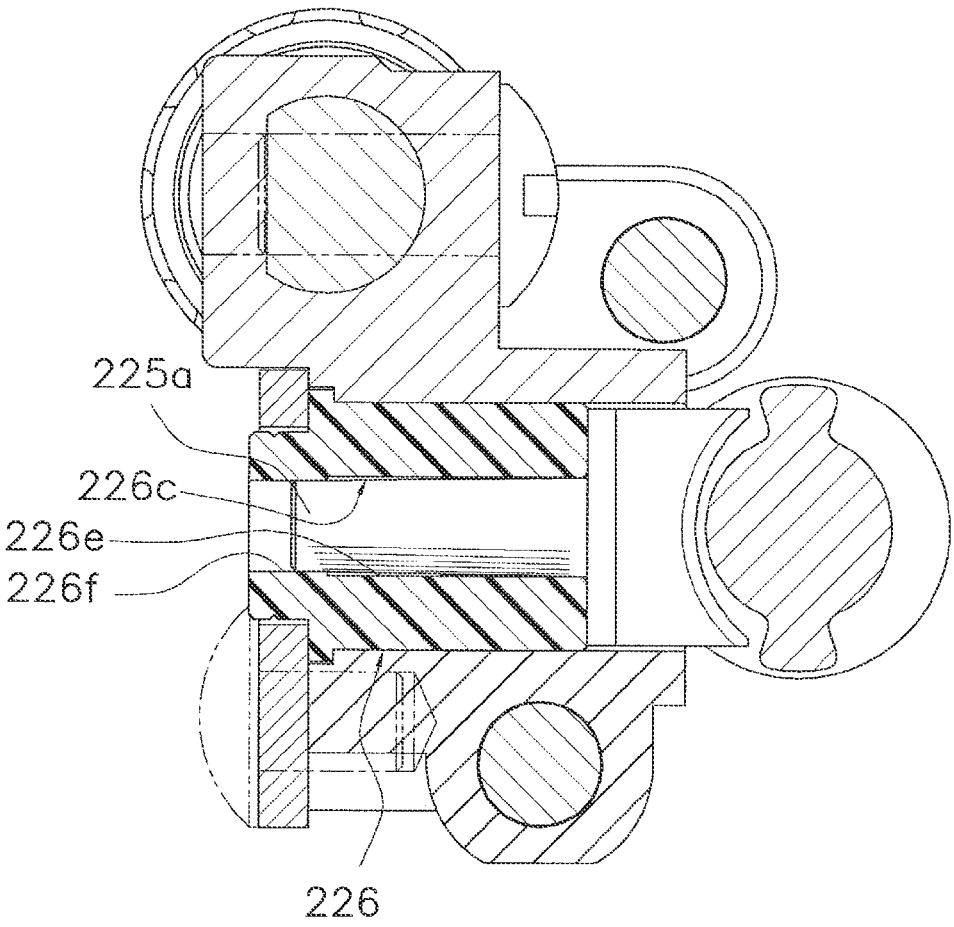

FIG. 9

SPINNING REEL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to Japanese Patent Application No. 2013-008341 filed on Jan. 21, 2013. The entirety disclosure Japanese Patent Application No. 2013-008341 is hereby incorporated herein by reference.

BACKGROUND

1. Field of the Invention

The present invention relates to a spinning reel, and particularly to an oscillating mechanism for a spinning reel, which is configured to reciprocate a spool back and forth in conjunction with rotation of a handle.

2. Background Art

Spinning reels are provided with an oscillating mechanism configured to reciprocate a spool back and forth in conjunction with rotation of a handle. The oscillating mechanism includes a traverse can shaft and a slider. Helical grooves, which intersect with each other, are formed on the traverse cam shaft. The slider can unitarily move a spool at least in the axial direction. A pinion gear, which is meshed with a drive gear produced in the form of a face gear, is rotatably mounted to the outer peripheral side of the spool shaft. Therefore, the slider is disposed adjacently to the drive gear, while avoiding interference with the drive gear.

The slider includes a slider body and an engaging member. The spool shaft is coupled to the slider body. The engaging member is engaged with the helical grooves, and is configured to reciprocate the slider body back and forth by rotation of the traverse cam shaft. The engaging member is attached to the interior of the slider body, while being rotatable about an axis perpendicular to the traverse cam shaft.

SUMMARY

A well-known oscillating mechanism has a structure that a shaft part of the engaging member is rotatably supported by a bearing within the slider (see Publication of Japan Patent No. 5008321). In the well-known oscillating mechanism, a retainer member for retaining the bearing is disposed in contact with an end of the bearing. The retainer member is fixed to the slider body by a screw member.

It can be considered to further smoothly rotate the engaging member in order to improve the oscillating mechanism. Specifically, when tilted, the engaging member is unlikely to be smoothly rotated even with use of a bearing. This is attributed to the fact that the engaging member is rotated to a great extent on the both ends of the helical grooves of the traverse cam shaft. In view of the above, there is an idea to prolong the shaft part of the engaging member that is supported by the bearing. When the shaft part is prolonged, the engaging member is less easily tilted. The engaging member can be thereby further smoothly rotated. However, when the shaft part is prolonged in the well-known oscillating mechanism, the width (i.e., the length along the axial direction of the shaft part) of the slider body disposed adjacently to the drive gear is inevitably increased. This brings increase in size of the reel.

It is an advantage of the present invention to increase the length of a shaft part of an engaging member as much as possible without increasing the width of a slider body in a spinning reel.

A spinning reel being configured to forwardly reel out a fishing line includes a handle, a reel unit, a rotor, a spool, a spool shaft, and an oscillating mechanism. The reel unit rotatably supports the handle. The rotor is rotatably supported by the reel unit. The spool has a bobbin trunk about which the fishing line is wound by the rotor. The spool is mounted on the spool shaft. The oscillating mechanism is configured to reciprocate the spool in a back-and-forth direction by a rotation of the handle. The oscillating mechanism includes a traverse cam and a slider. The traverse cam shaft has intersecting helical grooves on a surface thereof. The traverse cam shaft is disposed in parallel to the spool shaft. The traverse cam shaft is configured to be rotated in conjunction with the rotation of the handle. The slider includes a slider body, a through hole, an engaging member, a first bearing, a retainer member, and a fixation member. The through hole penetrates the slider body in a direction perpendicular to the traverse cam shaft. The slider body is coupled to the spool shaft to be unitarily movable therewith at least in an axial direction. The engaging member has a shaft part and an engaging part. The engaging part is mounted to a tip end of the shaft part to be engaged with the helical grooves. The engaging member is formed in a rod shape in order for a rear end of the shaft part to protrude out of the through hole. The first bearing has a fitted part, a protruding part, and a support hole. The fitted part is fitted into the through hole. The protruding part has a diameter smaller than a diameter of the fitted part. The fitted part includes a stepped surface on an end thereof abutting the protruding part. The protruding part protrudes out of the through hole. The support hole penetrates through the fitted part and the protruding part. The support hole rotatably supports the shaft part. The retainer member retains the first bearing at the stepped surface. The fixation member fixes the retainer member to the slider body.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the attached drawings which form a part of this original disclosure:

FIG. **1** is a side view of a spinning reel according to an exemplary embodiment of the present invention;

FIG. **2** is a cross-sectional side view of the spinning reel;

FIG. **3** is a cross-sectional view of FIG. **2** taken along a cutaway line III-III;

FIG. **4** is an exploded perspective view of an oscillating mechanism;

FIG. **5** is an enlarged cross-sectional side view of the oscillating mechanism;

FIG. **6** is an enlarged cross-sectional view of the oscillating mechanism and its periphery in FIG. **3**;

FIG. **7** is a side view of a slider;

FIG. **8** is a diagram corresponding to FIG. **5** in another exemplary embodiment; and

FIG. **9** is a diagram corresponding to FIG. **5** in yet another exemplary embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Entire Structure

In FIGS. **1**, **2**, and **3**, a spinning reel **100** according to an exemplary embodiment of the present invention is configured to forwardly reel out a fishing line. The spinning reel **100** includes a reel unit **2**, a rotor **3**, a spool **4**, a spool shaft **15**, a rotor drive mechanism **5**, and an oscillating mechanism **6**. The reel unit **2** rotatably supports a handle **1**. The rotor **3** is rotatably supported at the front of the reel unit **2**. The spool **4** has a bobbin trunk **4***a* that the fishing line is wound thereabout

by the rotor **3**. The spool **4** is disposed at the front of the rotor **3**, while being movable back and forth. The spool **4** is mounted to the tip end of the spool shaft **15**. The oscillating mechanism **6** is configured to reciprocate the spool **4** back and forth through the spool shaft **15** by the rotation of the handle **1**. It should be noted that the handle **1** is attachable to either the left side (see FIGS. **1** and **3**) or the right side of the reel unit **2**.

As illustrated in FIGS. **1** and **2**, the handle **1** is pivotably attached to the tip end of a handle shaft **8***a* (see FIG. **2**), and includes a handle arm **8***b*, a knob shaft (not illustrated in the figures), and a handle knob **8***c*. The handle arm **8***b* extends in a direction intersecting with the handle shaft **8***a*. The knob shaft is fixed to the tip end of the handle arm **8***b*. The handle knob **8***c* is rotatably attached to the knob shaft.

Structure of Reel Unit

The reel unit **2** includes a chassis **2***a*, a lid member **2***b*, a fishing rod attachment leg **2***c*, and a reel unit guard **7**. The chassis **2***a* is made of aluminum alloy or magnesium alloy, for instance, and contains a mechanism attachment space **2***d* with an opening. The rotor drive mechanism **5** and the oscillating mechanism **6** are disposed in the mechanism attachment space **2***d*. The rotor drive mechanism **5** is configured to rotate the rotor **3** in conjunction with the rotation of the handle **1**. The fishing rod attachment leg **2***c* serving to attach a fishing rod thereto is integrally formed with the chassis **2***a*. Further, a tubular portion **2***f* is formed in the front part of the chassis **2***a*.

The lid member **2***b* is made of for instance, aluminum alloy or magnesium alloy. The lid member **2***b* is provided for closing the mechanism attachment space **2***d* by covering the aforementioned opening **2***e* of the mechanism attachment space **2***d*. The fishing rod attachment leg **2***c* is a roughly T-shaped portion that extends forwards from the chassis **2***a* in an obliquely upward direction and is then extending in the back-and-forth direction. In the present exemplary embodiment, the fishing rod attachment leg **2***c* is integrally formed with the chassis **2***a*. However, the fishing rod attachment leg **2***c* can be integrally firmed with the lid member **2***b*. The reel unit guard **7** covers the rear surface, the rear part lateral surface, and the rear part bottom surface of the chassis **2***a* and those of the lid member **2***b*.

Structure of Rotor Drive Mechanism

As illustrated in FIGS. **2** and **3**, the rotor drive mechanism **5** includes a drive shaft **10**, a drive gear **11**, and a pinion gear **12**. The handle shaft **8***a* of the handle **1** is coupled to the drive shaft **10**, while being unitarily rotatable therewith. The drive gear **11** is made in the form of a face gear, and is configured to be rotated together with the drive shaft **10**. The pinion gear **12** is meshed with the drive gear **11**. The drive shaft **10** is, for instance, a tubular shaft made of stainless alloy. The both ends of the drive shaft **10** are supported by bearings (not illustrated in the figures) attached to the chassis **2***a* and the lid member **2***b*. The drive shaft **10** has female threaded portions (not illustrated in the figures) formed on the both ends of the inner peripheral surfaces thereof. The drive gear **11** is made in the form of a face gear, for instance, and is mounted onto the drive shaft **10** while being unitarily rotatable therewith. In the present exemplary embodiment, the drive gear **11** is detachably mounted onto the drive shaft **10**. It should be noted that the drive gear **11** can be integrated with the drive shaft **10**.

The pinion gear **12** is, for instance, a tubular member made of stainless alloy. As illustrated in FIG. **2**, a front portion **12***a* of the pinion gear **12** is fixed to the rotor **3** by a nut **13**, while penetrating through the center part of the rotor **3**. Thus, the pinion gear **12** is unitarily rotatable with the rotor **3**. The nut **13** is prevented from turning by a retainer **18**. The retainer **18** is fixed to the rotor **3**. The pinion gear **12** is rotatably supported by the chassis **2***a* through bearings **14***a* and **14***b* attached to the chassis **2***a* at a predetermined interval. Specifically, the bearing **14***a* supports the axially intermediate portion of the pinion gear **12**, whereas the beating **14***b* supports the axially rear end portion of the pinion gear **12**.

Structure of Oscillating Mechanism

As illustrated in FIGS. **2** and **3**, the oscillating mechanism **6** is configured to move the spool shaft **15** coupled to the center part of the spool **4** through a drag mechanism **60** in the back-and-forth direction. The spool **4** is thereby configured to be reciprocated in the back-and-forth direction. As illustrated in FIGS. **4**, **5** and **6**, the oscillating mechanism **6** includes a traverse cam shaft **21**, a slider **22**, and an intermediate gear **23**. The traverse cam shaft **21** is disposed in a position that is lower than and laterally away from the spool shaft **15** (i.e., on the lower right side of the spool shaft **15** in FIG. **6**), while being arranged in parallel to the spool shaft **15**. The slider **22** is configured to be moved along the traverse cam shaft **21** in the back-and-forth direction. The intermediate gear **23** is mounted onto the tip end of the traverse cam shaft **21**, while being unitarily rotatable therewith.

The traverse cam shaft **21** is disposed along the back-and-forth direction, while the both ends thereof are rotatably supported by the chassis **2***a* through rolling bearings. The traverse cam shaft **21** has intersecting helical grooves **21***a* on the surface thereof. The traverse cam shaft **21** is configured to be rotated in conjunction with the rotation of the handle **1**.

As illustrated in FIG. **3**, the slider **22** is disposed adjacently to the drive gear **11** meshed with the pinion gear **12** mounted onto the spool shaft **15**. As illustrated in FIGS. **4**, **6**, and **7**, the slider **22** includes a slider body **24**, an engaging member **25**, a first bearing **26**, a retainer member **27**, a screw member **28** (an exemplary fixation member), and a second bearing **29**. The rear end of the spool shaft **15** is non-rotatably fixed to the slider **22**. The slider body **24** has a spool shaft coupled portion **24***a*, an engaging member attached portion **24***b*, a first guide portion **24***c*, and a second guide portion **24***d*. The rear end of the spool shaft **15** is non-rotatably coupled to the spool shaft coupled portion **24***a*. The engaging member **25** is attached to the engaging member attached portion **24***b*. The first and second guide portions **24***c* and **24***d* serve to guide the slider **22** in the back-and-forth direction.

The spool shaft coupled portion **24***a* is formed in a roughly cuboid shape and has a spool shaft attached hole **24***e*. The spool shaft attached hole **24***e* has a D-shaped cross-section and penetrates through the spool shaft coupled portion **24***a* in the back-and-forth direction. The rear end of the spool shaft **15** is fitted into the spool shaft attached hole **24***e* and is fixed thereto by, for instance, adhesive. Further, the rear end of the spool shaft **15** is also fixed by a screw member **37** to be screwed into the spool shaft **15**. Accordingly, the rear end of the spool shaft **15** is fixed to the slider body **24**.

The engaging member attached portion **24***b* is a roughly tubular portion having a through hole **24***f*. The through hole **24***f* is formed along the right-and-left direction arranged substantially perpendicular to the traverse cam shaft **21**. The through hole **24***f* has a large-diameter portion **24***g*. The large-diameter portion **24***g* is thrilled on one end of the through hole **24***f*, i.e., the end disposed away from the traverse cam shaft **21**. Further, the through hole **24***f* has a pair of restriction protrusions **24***h* (see FIG. **7**). The restriction protrusions **24***h*

are formed on the inner peripheral surface of the other end of the through hole **24***f*, i.e., the end disposed closer to the traverse cam shaft **21**. The restriction protrusions **24***h* are exemplary restriction portions for restricting the axial moving of and the rotational range of the engaging member **25**. Each restriction protrusion **24***h* has a predetermined thickness and is protruding in a circular-arc shape towards the axis of the through hole **24***f*. It should be noted that the engaging member attached portion **24***b* has a shaft mount portion **24***i* on the end surface closer to the traverse cam shaft **21**, i.e., the end surface of the part that the restriction protrusions **24***h* are formed. The shaft mount portion **24***i* is recessed in a circular-arc shape and serves to dispose the traverse cam shaft **21** adjacently to the slider body **24**.

The first guide portion **24***c* is protruding from the wall surface of the spool shaft coupled portion **24***a*, i.e, the wall surface closer to the traverse cam shaft **21**. The first guide portion **24***c* has a first guide hole **24***j* that a first guide shaft **38***a* penetrates therethrough. The first guide shaft **38***a* serves to guide the slider **22** in the back-and-forth direction. The both ends of the first guide shaft **38***a* are supported by the chassis **2***a*. The second guide portion **24***d* is downwardly protruding from the bottom surface of the engaging member attached portion **24***b*. The second guide portion **24***d* has a second guide hole **24***k* that a second guide shaft **38***b* penetrates therethrough. The second. guide shaft **38***b* serves to guide the slider **22** in the back-and-forth direction. The both ends of the second guide shaft **38***b* are supported by the chassis **2***a*. Therefore, the traverse cam shaft **21** is disposed between the first guide shaft **38***a* and the second guide shaft **38***b* in the up-and-down direction.

The engaging member attached portion **24***b* has a mount surface **24***m* onto which the retainer member **27** is mounted. The mount surface **24***m* is formed on the end surface of the engaging member attached portion **24***b*, i.e., the end surface disposed away from the traverse cam shaft **21**. The mount surface **24***m* is further recessed than the spool shaft coupled portion **24***a*. A screw attached portion **24***n* is circularly formed below the mount surface **24***m*. The screw member **28** is screwed into the screw attached portion **24***n*. The recessed depth of the mount surface **24***m* is greater than or equal to the thickness obtained by adding the thickness of a head portion **28***a* of the screw member **28** and that of the retainer member **27**.

As illustrated in FIGS. **4** and **6**, the engaging member **25** has a shaft part **25***a* and an engaging part **25***b*. The engaging part **25***b* is disposed on the tip end of the shaft part **25***a*. The engaging part **25***b* can be engaged with the helical grooves **21***a*. The engaging member **25** is a rod-shaped member made of metal. The engaging member **25** is disposed while the rear end of the shaft part **25***a* is protruding out of the through hole **24***f* The shaft part **25***a* has a first shaft portion **25***c* and a second shaft portion **25***d*. The first shaft portion **25***c* extends to the engaging part **25***b*. The second shaft portion **25***d* extends to the first shaft portion **25***c* and has a diameter smaller than that of the first shaft portion **25***c*. The engaging part **25***b* has a disc portion **25***e* and an engaging piece **25***f*. The disc portion **25***e* is a large diameter portion to be fitted into the through hole **24***f*. The engaging piece **25***f* is formed in a plate shape and is protruding from the disc portion **25***e* towards the traverse cam shaft **21**. The engaging piece **25***f* is engaged with the helical grooves **21***a*. The tip end of the engaging piece **25***f* is formed in a circular-arc shape along the bottom portions of the helical grooves **21***a*. The tip end of the engaging piece **25***f* is tapered. Specifically, the lateral surfaces (plate faces) of the engaging piece **25***f* are slanted at the tip end of the engaging piece **25***f*. A first surface **25***g* of the disc portion **25***e*, which is disposed closer to the traverse cam shaft **21**, restricts the engaging member **25** from moving towards the traverse cam shaft **21** when making contact with the restriction protrusions **24***h*. Accordingly, the engaging part **25***b* is axially positioned, and the interval between the engaging part **25***b* and the traverse cam shaft **21** is kept constant. Further, the rotational range of the engaging member **25** is restricted when the both lateral surfaces of the engaging piece **25***f* make contact with the restriction protrusions **24***h*.

The first bearing **26** is disposed for rotatably supporting the shaft part **25***a* of the engaging member **25**. For example, the first beating **26** is a tubular slide beating made of synthetic resin with a relatively high sliding performance (polyacetal resin, fluoropolymer, etc.). The first bearing **26** has a fitted part **26***a*, a protruding part **26***b*, and a support hole **26***c*. The fitted part **26***a* is fitted into the through hole **24***f*. The protruding part **26***b* has a diameter smaller than that of the fitted part **26***a* and is protruding out of the through hole **24***f*. The support hole **26***c* penetrates through the fitted part **26***a* and the protruding part **26***b*, and rotatably supports the shaft part **25***a*. The fitted part **26***a* has a large-diameter brimmed portion **26***d* on its boundary portion abutting the protruding part **26***b*. The brimmed portion **26***d* is engaged with the large-diameter portion **24***g*, and thereby, sets the position of the first bearing **26**. Specifically, the brimmed portion **26***d* makes contact with the wall surface of the large-diameter portion **24***g*, and thereby, restricts the first bearing **26** from moving in a direction closer to the traverse cam shaft **21**. Accordingly, the first bearing **26** is axially positioned. The support hole **26***c* has a first support hole portion **26***e* and a second support hole portion **26***f*. The first support hole portion **26***e* supports the first shaft portion **25***c*, whereas the second support hole portion **26***f* supports the second shaft portion **25***d*. The first support hole portion **26***e* is formed in a portion of the inner periphery of the fitted part **26***a*. The second support hole portion **26***f* is formed in the rest of the inner periphery of the fitted part **26***a* and the inner periphery of the protruding part **26***b*.

The retainer member **27** is mounted to the mount surface **24***m*, and thereby, presses and retains the first bearing **26**. The fitted part **26***a* includes a stepped surface **26***g* at an end thereof which abuts the protruding part **26***b*. The retainer member **27** retains the first bearing **26** with the stepped surface **26***g*. The retainer member **27** is a plate-shaped member made of metal such as stainless alloy. The retainer member **27** has a pass-through hole **27***a* that the protruding part **26***b* can pass therethrough. The retainer member **27** is fixed to the slider body **24** by the screw member **28**. The screw member **28** is screwed into the screw attached portion **24***n* of the slider body **24**, while penetrating through the retainer member **27**.

The second bearing **29** is, for instance, a rolling bearing such as a ball bearing or a roller bearing. The second bearing **29** is axially aligned with the first bearing **26** within the through hole **24***f*. Specifically, the second bearing **29** is disposed on the engaging part **25***b* side of the first bearing **26**. In other words, the second bearing **29** is disposed between the first bearing **26** and the engaging part **25***b*. A washer member **39** is disposed between the first bearing **26** and the second bearing **29**. The washer member **39** serves to suppress wobbling of the second bearing **29** in the axial direction. An outer race **29***a* of the second bearing **29** makes contact with the washer member **39**. On the other hand, an inner race **29***b* of the second bearing **29** makes contact with a second surface **25***h* of the disc portion **25***e* of the engaging member **25**, i.e., the surface disposed on the opposite side of the first surface **25***g*.

The intermediate gear **23** is meshed with the pinion gear **12** through a reduction mechanism **52**. The intermediate gear **23**

is attached to the front end of the traverse cam shaft **21** by non-circular coupling, while being unitarily rotatable therewith. The reduction mechanism **52** is configured to reduce the rotation of the pinion gear **12** and transmit the reduced rotation to the intermediate gear **23**. The reduction mechanism **52** includes a first gear **53** and a second gear **54**. The first gear **53** is meshed with the pinion gear **12**. The second gear **54** is meshed with the intermediate gear **23**. The second gear **54** is unitarily rotatable with the first gear **53**. The number of gear teeth of the first gear **53** is greater than that of the pinion gear **12**. The number of gear teeth of the second gear **54** is less than that of the intermediate gear **23**. With the structures, the rotation of the pinion gear **12** is transmitted to the intermediate gear **23**, while being reduced in two stages. The back-and-forth moving speed of the spool **4** is thereby reduced, and the fishing line can be densely wound about the bobbin trunk **4***a*. In the present exemplary embodiment, the first gear **53** is coupled to the second gear **54** by non-circular coupling, while being unitarily rotatable therewith. The second gear **54** is rotatably supported by a support shaft **55**. The both ends of the support shaft **55** are supported by the front part of the chassis **2***a*. The first gear **53** and the pinion gear **12** are herein helical gears, whereas the intermediate gear **23** and the second gear **54** are spur gears.

As illustrated in FIG. **2**, the spool shaft **15** is disposed while penetrating through the center part of the pinion gear **12**. The spool shaft **15** is configured to be reciprocated back and forth in the inside of the pinion gear **12** by the oscillating mechanism **6**. The intermediate portion of the spool shaft **15** is supported by a beating **16** attached to the inside of the nut **13**, while the rear portion of the spool shaft **15** is supported by the inner peripheral surface of the rear portion of the pinion gear **12**. Accordingly, the spool shaft **15** is rotatably supported, while being axially movable.

Structure of Rotor

As illustrated in FIG. **2**, the rotor **3** is rotatably supported by the reel unit **2** through the pinion gear **12**. The rotor **3** includes a rotor body **30**, a first cover member **32**, a second cover member **33**, and a bail arm **36**. The rotor body **30** is coupled to the pinion gear **12**, while being unitarily rotatable therewith.

The rotor body **30** includes a coupling part **30***a*, a first rotor arm **30***b*, and a second rotor arm **30***c*. The coupling part **30***a* is a closed-end tubular part rotatably coupled to the reel unit **2** through the pinion gear **12**. The first rotor arm **30***b* is forwardly extending from a first side (upper side in FIG. **2**) of the rear end portion of the coupling part **30***a*, while being away from the coupling part **30***a* at an interval. The second rotor arm **30***c* is forwardly extending from a second side (lower side in FIG. **2**), which is opposite to the first side, of the rear end portion of the coupling part **30***a*, while being away from the coupling part **30***a* at an interval. The rotor body **30** is made of either aluminum alloy or magnesium alloy, for instance, and is integrally molded.

The coupling part **30***a* has a wall portion **31***a* formed in the front part thereof. The wall portion **31***a* has a boss **31***b* in the center part thereof. The boss **31***b* has a through hole **31***c* bored in the center part thereof. The front portion **12***a* of the pinion gear **12** and the spool shaft **15** penetrate through the through hole **31***c*. The nut **13** is disposed in front of the wall portion **31***a*. The rotor **3** is fixed to the pinion gear **12** by the nut **13**. The coupling part **30***a* has a recessed portion **31***d* formed in the rear part thereof. The recessed portion **31***d* has a circular space in which the front part of the reel unit **2** can be accommodated.

The first cover member **32** covers the radially outside of the first rotor arm **30***b*. A bail flip mechanism (not illustrated in the figures) is mounted between the first cover member **32** and the first rotor arm **30***b*. The bail flip mechanism is configured to selectively urge the bail arm **36** between a fishing-line winding position and a fishing-line releasing position.

As illustrated in FIG. **2**, the bail arm **36** is attached to the tip ends of the first and second rotor arms **30***b* and **30***c*, while being pivotable between the fishing-line releasing position and the fishing-line winding position. When set in the fishing-line winding position, the bail arm **36** is configured to wind the fishing line onto the spool **4** by the rotation of the rotor **3** in the fishing-line winding direction.

The bail arm **36** includes a first bail support member **40**, a second bail support member **42**, and a line roller **41**. The first bail support member **40** is pivotably attached to the outer peripheral side of the tip end of the first rotor arm **30***b*. The second bail support member **42** is pivotably attached to the outer peripheral side of the tip end of the second rotor arm **30***c*. The line roller **41** is rotatably attached to the tip end of the first bail support member **40**. Further, the bail arm **36** includes a stationary shaft (not illustrated in the figures), a stationary shaft cover **44**, and a bail **45**. The stationary shaft is a member for supporting the line roller **41**. The stationary shaft is fixed to the tip end of the first bail support member **40**, while being cantilevered by the first bail support member **40**. The stationary shaft cover **44** is disposed on the tip-end side of the stationary shaft. The bail **45** couples the stationary shaft cover **44** and the second bail support member **42**.

Other Structures

As illustrated in FIG. **2**, an anti-reverse mechanism **50**, which is configured to prevent the reverse rotation of the rotor **3**, is disposed in the interior of the tubular portion **2***f* of the reel unit **2**. The anti-reverse mechanism **50** includes a one-way clutch **51**. The one-way clutch **51** is of a roller type with a free-wheeling inner race. The anti-reverse mechanism **50** is configured to constantly prevent the rotor **3** from rotating reversely (i.e., in the fishing-line releasing direction). Therefore, the anti-reverse mechanism **50** never allows the reverse rotation of the rotor **3**. It should be noted that the anti-reverse mechanism **50** can be configured to be switchable between a reverse rotation allowed state and a reverse rotation prevented state. The anti-reverse mechanism **50** is retained by a cap member **20** fixed to the tubular portion **2***f* For example, the cap member **20** is screwed onto the outer peripheral surface of the tubular portion **2***f*.

As illustrated in FIG. **2**, the spool is disposed between the first and second rotor arms **30***b* and **30***c* of the rotor **3**. The spool **4** is rotatably supported by the tip end of the spool shaft **15**. The spool **4** is configured to be moved back and forth together with the spool shaft **15**, and simultaneously, the fishing line is wound onto the outer periphery of the bobbin trunk **4***a* by the rotor **3**. The spool **4** is made of for instance, aluminum alloy. The spool **4** accommodates the drag mechanism **60** in the interior thereof. The drag mechanism **60** is configured to brake the spool **4** for applying a set amount of drag three to the spool **4**.

As illustrated in FIG. **2**, the drag mechanism **60** is configured to brake the rotation of the spool **4** in the fishing-line releasing direction in order to apply drag force to the spool **4**. The drag mechanism **60** includes a drag knob assembly **65** and a friction part **66**. The drag knob assembly **65** is provided for manually regulating drag force. The friction part **66** is configured to be pressed towards the spool **4** by the drag knob assembly **65**, and thereby, drag force is regulated. The drag

knob assembly **65** is disposed in front of the spool **4**. The friction part **66** is disposed in the interior of the spool **4**.

Action of Oscillating Mechanism

When the handle **1** is rotated in the spinning reel **100** structured as described above, the drive shaft **10** is rotated and the pinion gear **12** meshed with the drive gear **11** is rotated. When the pinion gear **12** is rotated, the rotor **3** is rotated. Accordingly, the intermediate gear **23** is rotated through the reduction mechanism **52**, and the traverse earn shaft **21** is rotated. When the traverse cam shaft **21** is rotated, the engaging part **25***b* of the engaging member **25** attached to the slider body **24** is engaged with the helical grooves **21***a*, and is rotated and moved back and firth by the action of the helical grooves **21***a*. The slider **22** is thereby reciprocated back and forth, and the spool **4** is moved back and forth. The first bearing **26** is herein retained by the retainer member **27** not at the end thereof but at the step thereof produced between the fitted part **26***a* and the protruding part **26***b*. Therefore, the axial length of the shaft part **25***a* of the engaging member **25** can be increased as much as possible without increasing the width of the slider body **24**, i.e., the length of the slider body **24** in the tight-and-left direction. Hence, the engaging member **25** can be prevented from easily wobbling even when the engaging member **25** is rotated to a great extent at the both ends of the helical grooves **21***a*.

Other Exemplary Embodiments

An exemplary embodiment of the present invention has been described above. However, the present invention is not limited to the aforementioned exemplary embodiment, and a variety of changes can be made without departing from the scope of the present invention. Especially, a plurality of exemplary embodiments and modifications described in the present specification can be arbitrarily combined on an as-needed basis. In should be noted that in the following description of other exemplary embodiments, explanation will be made for components structured differently from the corresponding ones of the aforementioned exemplary embodiment while three-digit reference numbers are assigned to the components. The three-digit reference numbers, which are assigned to the components of the following exemplary embodiments, are produced by changing reference numbers assigned to the corresponding components of the aforementioned exemplary embodiment. Further, explanation will be omitted for such components that are similar to those of the aforementioned exemplary embodiment.

(a) In the aforementioned exemplary embodiment, the shaft part **25***a* of the engaging member **25** is composed of the first shaft portion **25***c* and the second shaft portion **25***d*. However, the present invention is not limited to the structure. As illustrated in FIG. **8**, a shaft part **125***a* can be formed with a constant diameter. In this case, a first bearing, which is made of synthetic resin, can be disposed in the through hole **24***f* over the roughly entire length of the through hole **24***f* without providing a second bearing.

(b) As illustrated in FIG. **9**, only a first bearing **226** can be provided for supporting a shaft part **225***a* without providing a second bearing. The first bearing **226** is herein disposed in the through hole over the roughly entire length of the through hole. Further, a shaft part **226***a* is tapered towards the tip end thereof such that the protruding side thereof has a smaller diameter. Especially when barrel polishing is performed after machining of the engaging member for the purposes of deburring, removal of cutting marks, and so froth, the shaft part **25***a* is preferably composed of the first shaft portion **25***c* and the second shaft portion **25***d* having a diameter smaller than the first shaft portion **25***c* as illustrated in FIG. **6**, or alternatively, the shaft part **225***a* is preferably formed in a tapered shape as illustrated in FIG. **9**. Thus, even when the diameter of the tip end side becomes smaller than that of the engaging part side in the shaft part **225***a* as a result of barrel polishing, this does not negatively affect too much the structure of supporting the shaft part **225***a* only by the first bearing **226**.

In the exemplary embodiment illustrated in FIG. **9**, a support hole **226***c* of the first bearing **226** is composed of a first support hole portion **226***e* and a second support hole portion **226***f* having a diameter slightly smaller than that of the first support hole portion **226***e*. The shaft part **225***a* is supported by the end, which is closer to the engaging part **25***b*, of the first bearing **226** and the boundary between the first support hole portion **226***e* and the second support hole portion **226***f*.

(c) In the aforementioned exemplary embodiment, the first bearing **26** is provided with the large-diameter brimmed portion **26***d*. However, the first bearing **26** is not required to be provided with such brimmed portion. In this case, the washer member **39** and the second bearing **29** can be configured to be pressed by the retainer member **27** through the first bearing **26**.

(d) In the aforementioned exemplary embodiment, the present invention has been explained by exemplifying the spinning reel **100** of a front drag type that the spool shaft **15** is non-rotatably coupled to the slider body **24**. However, the object to which the present invention is applied is not limited to the spinning reel **100**. For example, the present invention is similarly applicable to a spinning reel of a rear drag type that the spool shaft is coupled to the slider body while being rotatable and axially immovable and a spinning reel configured to switch activation of a front drag mechanism and that of a rear drag mechanism by a switch member. Further, the present invention is also applicable to a spinning reel of a lever brake type configured to brake not the spool but the rotor.

(e) In the aforementioned exemplary embodiment, the screw member **28** has been exemplified as a fixation member. However, the fixation member is not limited to the screw member **28** in the present invention. For example, an elastic engaging pin can be used as the fixation member. The elastic engaging pin is herein elastically engaged with the slider body **24**.

Features

The aforementioned exemplary embodiments can be expressed as follows.

(A) The spinning reel **100** is a reel configured to forwardly reel out the fishing line. The spinning reel **100** includes the handle **1**, the reel unit **2**, the rotor **3**, the spool **4**, the spool shaft **15**, and the oscillating mechanism **6**. The reel unit **2** rotatably supports the handle **1**. The rotor **3** is rotatably supported by the reel unit **2**. The spool **4** has the bobbin trunk **4***a* that the fishing line is wound thereabout by the rotor **3**. The spool shaft **15** is a member that the spool **4** is mounted. The oscillating mechanism **6** is configured to reciprocate the spool **4** in the back-and-forth direction by the rotation of the handle **1**. The oscillating mechanism **6** includes the traverse cam shaft **21** and the slider **22**. The traverse cam shaft **21** has the intersecting helical grooves **21***a* on the surface thereof. The traverse cam shaft **21** is disposed in parallel to the spool shaft **15**. The traverse cam shaft **15** is configured to be rotated in conjunction with the rotation of the handle **1**. The slider **22**

includes the slider body **24**, the engaging member **25**, the first bearing **26**, the retainer member **27**, and the screw member **28**. The slider body **24** has the through hole **24***f* penetrating therethrough in the direction perpendicular to the traverse can shaft **21**. The slider body **24** is coupled to the spool shaft **15** so as to be unitarily movable therewith at least in the axial direction. The engaging member **25** has the shaft part **25***a* and the engaging part **25***b*. The engaging part **25***b* is mounted to the tip end of the shaft part **25***a* so as to be capable of being engaged with the helical grooves **21***a*. The engaging member **25** is formed in a rod shape such that the rear end of the shaft part **25***a* is protruding out of the through hole **24***f*. The first bearing **26** has the fitted part **26***a*, the protruding part **26***b* and the support hole **26***c*. The fitted part **26***a* is fitted into the through hole **24***f*. The protruding part **26***b* has a diameter smaller than that of the fitted part **26***a*. The protruding part **26***b* is protruding out of the through hole **24***f*. The support hole **26***c* penetrates through the fitted part **26***a* and the protruding part **26***b*. The support hole **26***c* serves to support rotatably the shaft part **25***a*. The retainer member **27** retains the first bearing **26** at the stepped surface **26***g* produced in the boundary between the fitted part **26***a* and the protruding part **26***b*. The screw member **28** fixes the retainer member **27** to the slider body **24**.

In the spinning reel **100**, the first bearing **26** of the oscillating mechanism **6** is retained by the retainer member **27** not at the end of the first bearing **26** but at the stepped surface **26***g*. With the structure, the shaft part **25***a* of the engaging member **25** is supported by the support hole **26***c* bored inside the fitted part **26***a* and the protruding part **26***b*. The length of the shaft part **25***a* can be thereby set regardless of the width of the slider body **24**. Thus, the length of the shaft part **25***a* of the engaging member **25** can be increased as much as possible without increasing the width of the slider body **24**.

(B) In the spinning reel **100**, the fixation member is the screw member **28** having the head portion **28***a*. In this case, by denting the part to which the retainer member **27** is attached, chances can be reduced that the head portion **28***a* of the screw member **28** is protruding from the slider body **24**.

(C) In the spinning reel **100**, a part of the slider body **24** for disposing the retainer member **27** is further recessed than another part of the slider body **24** for coupling the spool shaft **15**. In this case, by setting the recessed depth to be greater than the thickness of the head portion **28***a*, chances can be reduced that the head portion **28***a* of the screw member **28** is protruding from the slider body **24**. Accordingly, the slider **22** can be disposed closer to the drive gear **11** as much as possible. Consequently, the drive gear **11** can be firmed with a large diameter without forming the reel unit **2** with a large size.

(D) in the spinning reel **100**, the retainer member **27** is a plate-shaped member having the pass-through hole **27***a*. The pass-through hole **27***a* allows the protruding part **26***b* to pass therethrough. Further, the slider body **24** has the mount surface **24***m* allowing the retainer member **27** to be mounted thereto. In this case, the retainer member **27** can be easily fabricated because the retainer member **27** is a plate-shaped member. Further, the slider body **24** can be also easily formed because the part on which the retainer member **27** is mounted is a flat surface.

(E) In the spinning reel **100**, the first bearing **26** is a slide beating made of synthetic resin. In this case, the fitted part **26***a* and the protruding part **26***b* having a diameter smaller than that of the fitted part **26***a* can be easily formed by die forming.

(F) In the spinning reel **100**, the shaft part **25***a* has the first shaft portion **25***c* and the second shaft portion **25***d*. The first shaft portion **25***c* extends to the engaging part **25***b*. The second shaft portion **25***d* extends to the first shaft portion **25***c*. The second shaft portion **25***d* has a diameter smaller than that of the first shaft portion **25***c*. Further, the support hole **26***c* has the first support hole portion **26***e* and the second support hole portion **26***f*. The first support hole portion **26***e* supports the first shaft portion **25***c*. The second support hole portion **26***f* supports the second shaft portion **25***d*. In this case, the shaft part **25***a* is composed of the first shaft portion **25***e* and the second shaft portion **25***d*. The first shaft portion **25***c* has a large diameter and is disposed closer to the engaging part **25***b*, whereas the second shaft portion **25***d* has a small diameter and is disposed away from the engaging part **25***b*. Therefore, even when the shaft part **25***a* is slanted, resistance against the rotation of the engaging member **25** is reduced.

(G) in the spinning reel **100**, the first support hole portion **26***e* is disposed in a part of the inner periphery of the fitted part **26***a*, whereas the second support hole portion **26***f* is disposed in the rest of the inner periphery of the fitted part **26***a* and the inner periphery of the protruding part **26***b*. In this case, the boundary between the first support hole portion **26***e* and the second support hole portion **26***f* is disposed closer to the engaging part **25***b* than the boundary between the fitted part **26***a* and the protruding part **26***b* is. Therefore, the first bearing **26** can be accurately formed when being made of synthetic resin or the like.

(H) In the spinning reel **100**, the fitted part **26***a* has the brimmed portion **26***d* with a large diameter on its boundary portion abutting the protruding part **26***b*. Further, the through hole **24***f* has the large-diameter portion **24***g* allowing the brimmed portion **26***d* to be engaged therewith. In this case, the brimmed portion **26***d* makes contact with the wall surface of the large-diameter portion **24***g*, and thereby, the first bearing **26** can be restricted from moving in the direction closer to the engaging part **25***b*.

(I) In the spinning reel **100**, the engaging part **25***b* has the disc portion **25***e* and the engaging piece **25***f*. The disc portion **25***e* has a diameter larger than that of the shaft part **25***a*. The engaging piece **25***f* is formed in a plate shape and is protruding from the disc portion **25***e* towards the traverse cam shaft **21**. The engaging piece **25***f* is engaged with the helical grooves **21***a*. Further, the through hole **24***f* has the restriction protrusions **24***h*. The restriction protrusions **24***h* restrict the engaging member **25** from moving in the direction closer to the traverse cam shaft **2** by making contact with the disc portion **25***e*. Further, the restriction protrusions **24***h* restrict the rotational range of the engaging member **25** by making contact with the lateral surface of the engaging piece **25***f*. In this case, the restriction protrusions **24***h* can restrict the distance between the engaging member **25** and the traverse cam shaft **21** to be within a predetermined range, and can also restrict the rotational range of the engaging member **25**.

(J) In the spinning reel **100**, the slider **22** further includes the second hearing **29**. The second bearing **29** is disposed on the engaging part **25***b* side of the first bearing **26** within the through hole **24***f* so as to be axially aligned with the first bearing **26**. The second bearing **29** rotatably supports the shaft part **25***a* within the through hole **24***f*. In this case, the shaft part **25***a* is supported by the first bearing **26** and the second bearing **29** that are axially disposed in alignment with each other. Therefore, the shaft part **25***a* can be further smoothly rotated.

(K) In the spinning reel **100**, the second bearing **29** is a rolling bearing. In this case, the shaft part **25***a* can be further smoothly rotated, because the second bearing **29** is a rolling bearing.

Advantageous Effects of Invention

According to the present invention, the first bearing of the oscillating mechanism is retained by the retainer member not

at the end of the first bearing but at the stepped surface **26***g*. With the structure, the shaft part of the engaging member is supported by the support hole bored in the fitted part and the protruding part. Accordingly, the length of the shaft part can be set regardless of the width of the slider body. Therefore, the length of the shaft part of the engaging member can be increased as much as possible without increasing the width of the slider body.

GENERAL INTERPRETATION OF TERMS

In understanding the scope of the present invention, the term "comprising" and its derivatives, as used herein, are intended to be open ended terms that specify the presence of the stated features, elements, components, groups, integers, and/or steps, but do not exclude the presence of other unstated features, elements, components, groups, integers and/or steps. The foregoing also applies to words having similar meanings such as the terms, "including", "having" and their derivatives. Also, the terms "part," "section," "portion," "member" or "element" when used in the singular can have the dual meaning of a single part or a plurality of parts. Finally, terms of degree such as "substantially", "about" and "approximately" as used herein mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed. For example, these terms can be construed as including a deviation of at least ±5% of the modified term if this deviation would not negate the meaning of the word it modifies.

While only selected embodiments have been chosen to illustrate the present invention, it will be apparent to those skilled in the art from this disclosure that various changes and modifications can be made herein without departing from the scope of the invention as defined in the appended claims. Furthermore, the foregoing descriptions of the embodiments according to the present invention are provided for illustration only, and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

What is claimed is:

1. A spinning reel being configured to forwardly reel out a fishing line, comprising:

a handle;

a reel unit rotatably supporting the handle;

a rotor being rotatably supported by the reel unit;

a spool having a bobbin trunk about which the fishing line is wound by the rotor;

a spool shaft on which the spool is mounted; and

an oscillating mechanism being configured to reciprocate the spool in a back-and-forth direction by a rotation of the handle,

the oscillating mechanism including a traverse cam shaft and a slider,

the traverse cam shaft having intersecting helical grooves on a surface thereof, the traverse cam shaft being disposed in parallel to the spool shaft, the traverse cam shaft being configured to be rotated in conjunction with the rotation of the handle, and

the slider including

a slider body having a through hole penetrating therethrough in a direction perpendicular to the traverse cam shaft, the slider body being coupled to the spool shaft to be unitarily movable therewith at least in an axial direction,

an engaging member having a shaft part and an engaging part, the engaging part being mounted to a tip end of the shaft part to be engaged with the helical grooves, the engaging member being formed in a rod shape such that a rear end of the shaft part protrudes out of the through hole of the slider body,

a first bearing having a fitted part, a protruding part, and a support hole, the fitted part being fitted into the through hole, the protruding part having a diameter smaller than a diameter of the fitted part, the fitted part including a stepped surface on an end thereof abutting the protruding part, the protruding part protruding out of the through hole, the support hole penetrating through the fitted part and the protruding part, the support hole rotatably supporting the shaft part,

a retainer member retaining the first hearing at the stepped surface, and

a fixation member fixing the retainer member to the slider body.

2. The spinning reel according to claim **1**, wherein

the fixation member is a screw member having a head portion.

3. The spinning reel according to claim **2**, wherein

a first part of the slider body for disposing the retainer member is further recessed than a second part of the slider body for coupling the spool shaft.

4. The spinning reel according to claim **3**, wherein

the retainer member is a plate-shaped member having a pass-through hole,

the pass-through hole allows the protruding part to pass through the pass-through hole, and

the slider body has a mount surface allowing the retainer member to be mounted thereto.

5. The spinning reel according to claim **1**, wherein

the first hearing is a slide bearing made of synthetic resin.

6. The spinning reel according to claim **1**, wherein

the shaft part has a first shaft portion and a second shaft portion,

the first shaft portion extends to the engaging part,

the second shaft portion extends to the first shaft portion,

the second shaft portion has a diameter smaller than a diameter of the first shaft portion,

the support hole has a first support hole portion and a second support hole portion,

the first support hole portion supporting the first shaft portion, and

the second support hole portion supports the second shaft portion.

7. The spinning reel according to claim **6**, wherein

the first support hole portion is disposed in a part of an inner periphery of the fitted part, and

the second support hole portion is disposed in the rest of the inner periphery of the fitted part and an inner periphery of the protruding part.

8. The spinning reel according to claim **1**, wherein

the fitted part has a brimmed portion with a large diameter on a boundary portion thereof abutting the protruding part, and

the through hole has a large-diameter portion allowing the brimmed portion to be engaged therewith.

9. The spinning reel according to claim **1**, wherein

the engaging part has a disc portion and an engaging piece,

the disc portion has a diameter larger than a diameter of the shaft part,

the engaging piece is formed in a plate shape,

the engaging piece protrudes from the disc portion towards the traverse cam shaft,

the engaging piece is engaged with the helical grooves, and

the through hole has a restriction portion,

the restriction portion is configured to restrict the engaging member from moving in a direction closer to the traverse cam shaft by making contact with the disc portion, and

the restriction portion is configured to restrict a rotational range of the engaging member by making contact with a lateral surface of the engaging piece.

10. The spinning reel according to claim **1**, wherein

the slider further includes a second bearing,

the second bearing is disposed on the engaging part side of the first bearing within the through hole to be axially aligned with the first bearing, and

the second bearing rotatably supports the shaft part within the through hole.

11. The spinning reel according to claim **10**, wherein

the second bearing is a rolling bearing.

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